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1,058,586

PATENT SPECIFICATION

1,058,586

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COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Improvements in and relating to the Production of Shaped Articles from Organic Thermoplastic Materials

We IMPERIAL CHEMICAL INDUSTRIES LIMITED, of Imperial Chemical House, Millbank, London, S.W.1., a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to lightweight, substantially rigid or semi-rigid articles comprising organic thermoplastic materials, and to a method of moulding such articles.

There is a demand for light-weight containers and other articles of plastics materials, particularly for inexpensive articles of the type generally formed from wood boards, cardboard or metal sheet, including for example boxes or crates for fish, fruit or other commodities. The cost of such articles produced from plastics materials by standard moulding processes however is usually prohibitive compared with the cost of the articles in wood. The cost could be greatly reduced by producing the articles with hollow walls, thus achieving a great saving in the amount of material used. One possible method of forming the articles in this way is by an adaptation of the well-known rotational casting technique, using a double mould having a cavity of the shape of the box or other articles to be produced, the thermoplastic material forming a shell upon the walls of the mould which is removed after solidification as the finished article. Articles of the type described produced by this method, however, are generally insufficiently rigid for their intended application unless the amount of thermoplastic material used is sufficient to provide a shell of considerable thickness, thus adding to the cost of the article.

It is an object of the present invention to provide an improved method of making lightweight shaped articles from organic thermoplastic materials.

In accordance with the present invention, a method of moulding a box, crate, drum or like open mouthed hollow article from an organic thermoplastic material comprises moulding the article by rotational casting in a mould having opposed surfaces corresponding to the inner and outer surfaces of the desired article, at least one of the mould surfaces being formed with one or more projections into the mould cavity towards the opposite mould surface, and the organic thermoplastic material being introduced into the mould cavity in such an amount that the walls of the cast shell become fused together opposite the projections but are elsewhere separated by cavities.

In the term "organic thermoplastic material" as used throughout this specification we include polymer/plasticiser pastes, for example polyvinyl chloride/plasticiser pastes, which may be gelled by heating, as well as solid polymeric materials that may be brought to the molten state by heating. The materials may contain conventional additives, for example antioxidants, antistatic agents, fillers and colourants, and blends of two or more organic thermoplastic materials may be used.

The mouldings provided by this invention are of light weight and economical in the use of material, because of the cavities in the walls, but are strengthened by the fused portions of the walls, which may for example be of the nature of ribs, and are considerably more rigid than are similar containers formed with hollow walls of the same thickness, but without ribs or similar reinforcement.

The method of the invention may be carried out by introducing a solid thermoplastic into the mould, heating the mould before and/or during its rotation to bring

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Relative to
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the material to a molten state, and cooling the mould to solidify the material after the shell has been formed. Or it may be operated by introducing a predetermined amount of a fluid polymer/plasticiser paste into the mould, rotating the mould at a temperature below the setting temperature of the paste until the paste is substantially uniformly distributed upon the walls of the mould, and then heating the mould to gel the paste. The former method is particularly suitable for forming the articles from polythene or polypropylene, while the latter is especially suitable for forming them from polyvinyl chloride. Unplasticised polyvinyl chloride and vinyl chloride/vinyl acetate copolymer may also be moulded by the former method.

When a solid thermoplastic material is introduced into the mould, it is preferably in powdered, granular or other particulate form having a bulk density such that the mould may be substantially completely filled with the cold material before the moulding process. In this way, even distribution of the molten thermoplastic material is obtained without prolonged heating and rotation of the mould. The optimum bulk density will depend on the material being used, the shape of the moulding and the thickness of wall required, and is selected to produce a moulding having the desired characteristics. Generally, material having a bulk density not exceeding 0.75 times the specific gravity of the thermoplastic material will be used to give cavities providing a useful saving of material in the finished mouldings.

When a solid thermoplastic material is used in the moulding process, rotation of the mould is preferably begun before the material has been heated sufficiently for melting to begin. The mould may however be preheated to a lower temperature before rotation is begun, or before the mould is filled with the solid thermoplastic material; in fact, the mould will often be warm from previous use when it is filled.

One particular form of the invention will now be described by way of example with reference to the Drawing accompanying the Provisional Specification, which is a sectional perspective view of part of a mould suitable for use in the moulding of a flat panel. It will be clearly seen that the design of the mould illustrated may readily be adapted to provide, for example, a mould for an open-topped box or similar container, suitable for use in carrying out the method of the invention. The finished moulding is shown still in position in the mould.

In the Drawing, 1 and 2 are a pair of mould plates held together by clamps, 3; 4 are indentations in the mould plate 2 which form projections into the mould cavity, 5, towards the opposite mould plate, 1; and 6 is the moulding, the opposite sides of which are separated except at points 7, leaving cavities in the moulding.

The projections may have the form of ribs, as shown in the Drawing, following one direction, or, for providing greater rigidity, formed in a series crossing one another at right angles or another angle. Or they may be, for example, pyramidal or circular projections, or projections of other shape, in such number as to provide the desired amount of bonding between the opposed walls and the desired increase in rigidity of the product compared with a similar product formed in a mould without the projections. Both the mould walls may be formed with projections if desired, and may be flat or curved.

Articles that may advantageously be moulded by the method of this invention include, as well as boxes, crates and drums, other open-mouthed containers such as tubs and the like, baths, troughs, trays, boat hulls, tubular bodies.

In the production of tubular articles, the mould may be rotated about its longitudinal axis only; for articles of other shape, it is generally necessary to rotate the mould simultaneously about two or more axes, for example about two axes substantially at right angles to one another. Rotational casting apparatus suitable for this purpose is widely available, and conventional methods may be used for heating and cooling the mould. For example, the mould may be heated in an oven, by radiant heat, or by electrical heaters in or surrounding the mould walls, and cooled by water or cold air. When a solid thermoplastic material has been filled into the mould, and the shell of molten polymer formed, rotation of the mould is preferably continued while cooling, preferably rapid cooling, is applied.

Thermoplastic materials particularly suitable for use in the process of the invention are polythene and polypropylene. These materials have particularly suitable flow properties, and are tough and resilient; they are relatively inexpensive plastics materials, and thus their use does not detract from the great advantages of economy in the use of material obtained by the practice of this invention and low cost of the finished article.

Our invention is illustrated but in no way limited by the following Example.

EXAMPLE

A mould as shown in the Drawing accompanying the Provisional specification and described hereinbefore, having a separation of 0.5 inch and 0.25 inch between the walls at the widest and narrowest parts of the mould cavity respectively, was filled with polythene having a melt flow index of 20 and a specific gravity of 0.924, cut into granules passing a 1/8 inch sieve and having a bulk density of 0.40 g./cc. The filled mould was closed and

was then rotated about its longitudinal and transverse axes simultaneously, and while being rotated was heated for 10 minutes in an oven at 205°C. and then cooled with water. The shell was then removed from the mould; it had the form of a rigid panel, provided with ribs 0.6 inch wide at the joins between the walls, the walls of the shell between the ribs being 0.15 inch thick.

WHAT WE CLAIM IS:—

1. A method of moulding a box, crate, drum or like open mouthed hollow article from an organic thermoplastic material that comprises moulding the article by rotational casting in a mould having opposed surfaces corresponding to the inner and outer surfaces of the desired article, at least one of the mould surfaces being formed with one or more projections into the mould cavity towards the opposite mould surface, and the organic thermoplastic material being introduced into the mould cavity in such an amount that the walls of the cast shell become fused together opposite the projections, but are elsewhere separated by cavities.

2. A method as claimed in Claim 1 in which a solid organic thermoplastic material is introduced into the mould, is heated to bring it to a mobile liquid or semi-liquid condition, and is cooled to the solid state after the cast shell has been formed.

3. A method as claimed in Claim 2 in which the solid organic thermoplastic material is in a state of division such that its bulk density does not exceed 0.75 times the specific gravity of the organic thermoplastic material.

4. A method as claimed in Claim 3 in which the mould is initially substantially completely filled with the organic thermoplastic material.

5. A method as claimed in any one of the preceding claims in which the organic thermoplastic material is polythene or polypropylene.

6. A method as claimed in Claim 1 in which the organic thermoplastic material introduced into the mould is a fluid polymer/plasticiser paste which is heated to cause it to solidify after the shell has been formed on the walls of the mould.

7. A method as claimed in Claim 6 in which the organic thermoplastic material is a polyvinyl chloride plasticiser paste.

8. A method as claimed in any of the preceding claims in which the mould is rotated simultaneously about two or more axes.

9. A method of forming articles substantially as hereinbefore described with reference to the Drawing accompanying the Provisional Specification.

10. A hollow walled article of organic thermoplastic material, whenever made by a method as claimed in any of the preceding claims.

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1 SHEET

PROVISIONAL SPECIFICATION

This drawing is a reproduction of the Original on a reduced scale.